

WHAT IS CLAIMED IS:

1. A lithographic method for forming a pattern in a film carried on a substrate, comprising the steps of:

5 depositing a film on a substrate to provide a mold having a protruding feature and a recess formed thereby, the feature and the recess having a shape forming a mold pattern;

10 urging the mold into the film whereby the thickness of the film under the protruding feature is reduced and a thin region is formed in the film;

removing the mold from the film;

processing the relief whereby the thin region is removed exposing a portion of the surface of the substrate which underlies the thin region; and

15 whereby the exposed portion of the surface of the substrate substantially replicates the mold pattern,

the improvement comprising at least a portion of said protruding feature and a portion of said release have bonded thereto a release material comprising an inorganic linking group bonded to a molecular chain having release properties.

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2. The method of claim 1 wherein said release material comprises a material having the formula:



or

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RELEASE is a molecular chain of from 4 to 20 atoms in length, preferably from 6 to 16 atoms in length, which molecule has either polar or non-polar properties;

30

M is a metal or semimetal atom;

X is halogen or cyano, especially Cl, F, or Br;

R is hydrogen, alkyl or phenyl, preferably hydrogen or alkyl of 1 to 4 carbon atoms; and;

(n) is the valence -1 of M.

3. The process of claim 2 wherein RELEASE comprises a highly fluorinated organic group.
- 5 4. The process of claim 3 wherein said highly fluorinated group comprises a perfluorinated alkyl group.
5. The process of claim 2 wherein M is Si.
- 10 6. The process of claim 2 wherein X is halogen.
7. The process of claim 2 wherein X is chloro or bromo.
8. The process of claim 6 wherein M is Si.
- 15 9. The process of claim 7 wherein M is Si.
10. A process for improving the release properties of a surface comprising:
- 20 a) providing a surface;
- b) contacting that surface with a release forming material wherein said release forming material comprises a material having the formula:
- RELEASE-M(X)<sub>n-1</sub>-
- 25 or
- RELEASE-M(OR)<sub>n-1</sub>-, wherein
- RELEASE is a molecular chain of from 4 to 20 atoms in length, preferably from 6 to 16 atoms in length, which molecule has either polar or non-
- 30 polar properties;
- M is a metal or semimetal atom;
- X is halogen or cyano, especially Cl, F, or Br;
- R is hydrogen, alkyl or phenyl, preferably hydrogen or alkyl of 1 to 4 carbon atoms; and;
- 35 (n) is the valence -1 of M.

11. The process of claim 10 wherein said release forming material comprises a material of the formula:



wherein

RELEASE is a molecular chain of from 4 to 20 atoms in length, which molecular chain has either polar or non-polar properties;

M is a metal or semimetal atom;

X is halogen or cyano, especially Cl, F, or Br; and

(n) is the valence -1 of M.

12. The process of claim 11 wherein RELEASE comprises a highly fluorinated organic group.

13. The process of claim 12 wherein said highly fluorinated group comprises a perfluorinated organic group.

14. The process of claim 11 wherein said highly fluorinated group comprises a perfluorinated alkyl group of from 4 to 16 carbon atoms.

15. The process of claim 11 wherein M is Si.

16. The process of claim 12 wherein M is Si.

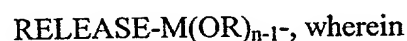
17. The process of claim 13 wherein M is Si.

18. The process of claim 14 wherein M is Si.

19. A surface having good antiadherent properties comprising a surface having bonded thereto the residue of material of the formula:



or



RELEASE is a molecular chain of from 4 to 20 atoms in length, preferably from 6 to 16 atoms in length, which molecule has either polar or non-polar properties;

M is a metal or semimetal atom;

5 X is halogen or cyano, especially Cl, F, or Br;

R is hydrogen, alkyl or phenyl, preferably hydrogen or alkyl of 1 to 4 carbon atoms; and;

(n) is the valence -1 of M,

10 said material being bonded to said surface only through a bond directly to M where a group X or OR has been removed to enable bonding to said surface, with the group RELEASE still attached to M.

20. The surface of claim 19 wherein said material comprises a material of the formula:

15 RELEASE-M(X)<sub>n-1</sub>-  
wherein

20 RELEASE is a molecular chain of from 4 to 20 atoms in length, preferably from 6 to 16 atoms in length, which molecule has either polar or non-polar properties;

M is a metal or semimetal atom;

X is halogen or cyano, especially Cl, F, or Br; and

(n) is the valence -1 of M.

25 21. The surface of claim 20 wherein RELEASE comprises a highly fluorinated group.

22. The surface of claim 21 wherein said highly fluorinated group comprises a perfluorinated group.

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23. The surface of claim 22 wherein said highly fluorinated group comprises a perfluorinated group of from 4 to 16 carbon atoms.

24. The surface of claim 20 wherein M is Si.

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25. The surface of claim 21 wherein M is Si.

26. The surface of claim 22 wherein M is Si.

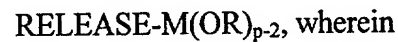
5 27. The surface of claim 23 wherein M is Si.

28. A surface having good antiadherent properties comprising a surface having bonded thereto the material of the formula:



10

or



15

RELEASE is a molecular chain of from 4 to 20 atoms in length, preferably from 6 to 16 atoms in length, which molecule has either polar or non-polar properties;

M is a metal or semimetal atom;

X is halogen or cyano, especially Cl, F, or Br;

R is hydrogen, alkyl or phenyl, preferably hydrogen or alkyl of 1 to 4 carbon atoms; and;

20

p is the valence of M,

said material being bonded to said surface only through a bond directly to M.

29 The surface of claim 19 wherein the surface comprises a  
25 patterned mold surface.

30. The method of claim 1 including heating the thin film to a temperature to allow sufficient softening of the film relative to the mold prior to the step of urging.

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31. The method of claim 1 wherein the feature on the mold is formed from material selected from the group consisting of: semiconductors, dielectrics, metals, ceramics, polymers and their combination.

32. The surface of claim 19 wherein said surface comprises a material selected from the group consisting of: semiconductors, dielectrics, metals, ceramics, polymers and their combination.

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33. The method of claim 1 wherein the step of processing comprises reactive ion etching.

34. The method of claim 1 including repeating the steps of obtaining  
10 a mold, urging, removing, and processing to form a multilayered device.

35. The method of claim 9 wherein the material is selected from the group consisting of semiconductors, dielectrics, metals, ceramics, polymers, and their combination.

15

36. A lithographic method for forming a pattern in a film carried on a substrate, comprising the steps of:

obtaining a substrate having a release coating thereon formed by  
20 the reaction of a compound of the formula  
RELEASE-M(X)<sub>n-1</sub>-

or

RELEASE-M(OR)<sub>n-1</sub>-, wherein

25 RELEASE is a molecular chain of from 4 to 20 atoms in length, preferably from 6 to 16 atoms in length, which molecule has either polar or non-polar properties;

M is a metal or semimetal atom;

X is halogen or cyano, especially Cl, F, or Br;

30 R is hydrogen, alkyl or phenyl, preferably hydrogen or alkyl of 1 to 4 carbon atoms; and;

(n) is the valence -1 of M,

depositing a film on the substrate;

obtaining a mold having a protruding feature and a recess formed  
thereby, the feature and the recess having a shape forming  
a mold pattern;  
urging the mold into the film creating a thickness contrast pattern in the  
film;  
removing the mold from the film; and  
transferring the thickness contrast pattern in the film onto the substrate.

37. A process for improving the release properties of a surface comprising:

- a) providing a surface;
- b) contacting that surface with a release forming material  
wherein said release forming material comprises a material  
having the formula:



- RELEASE is a molecular chain of from 4 to 20 atoms in length, preferably from  
6 to 16 atoms in length, which molecule has either polar or non-polar properties;

M is a metal or semimetal atom;

X is halogen or cyano, especially Cl, F, or Br;

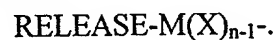
Q is a hydrogen or alkyl group,

- m is the number of Q groups,

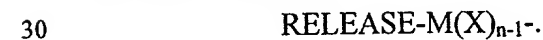
n-m-1 is at least 1, and

n is the valence -1 of M.

38. The process of claim 2 wherein said release material comprises a material  
having the formula:



39. The surface of claim 28 wherein said release material comprises a material  
having the formula:



40. The process of claim 38 wherein M is Si;

X is halogen Cl or Br;

RELEASE is perfluoroalkyl of 6 to 20 carbon atoms;

- and

n is 3.

41. The surface of claim 39 wherein M is Si;

X is halogen Cl or Br;

5 RELEASE is perfluoroalkyl of 6 to 20 carbon atoms  
and  
n is 3.

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